**Grade level:** Eighth Grade **Content:** The Pythagorean Theorem

**Lesson: Real** World Usage for the Pythagorean Theorem

**Next Generation Sunshine State Standards/Benchmarks:**

**MA.8.G.2.4** Validate and apply Pythagorean Theorem to find the distance in real-world situations or between points in the coordinate plane.

**Alternative: Next Generation Sunshine State Standards/Benchmarks**

**MA.8.G.6.2** Make reasonable approximations of square roots and mathematical expressions that include square roots, and use them to estimate solutions to problems and to compare mathematical expressions involving real numbers and radical expressions

**MA.8.A.6.4** Perform operations on real numbers (including integer exponents, radicals, percents, scientific notation, absolute value, rational numbers, and irrational numbers) using multistep and real world problems.

**MA.8.G.2.3** Demonstrate that the sum of angles in a triangle is 180-degrees and apply this fact to find unknown measure of angles, and the sum of angles in polygons.

**Lesson Objective:**

Students will validate the Pythagorean Theorem.

Students will find length using the Pythagorean Theorem.

**Alternative outcomes/objectives: (students will review and re-use skills in the following areas)**

Students will classify and determine the measure of angles.

Students will identify and classify triangles.

Students will solve problems using logical reasoning.

Students will find the squares of numbers and square roots of perfect squares.

**Prior Knowledge/Pre-skills:**

Basic addition, subtraction, multiplication and division skills.

Square Roots, Exponents, Single and Multi-step variable equations.

Inverse operations, angles, perimeter, area, triangle shapes and classifications.

**Materials:**

**What will the students need to complete the activities of this lesson?**

Math Connects Text book, Rulers, grid paper, protractors, calculators, algebra tiles, pencil, paper.

Power Point Lesson, Discovery Streaming Video Clip. Document camera, Interactive Whiteboard, A+LS Anywhere Learning System. KNSW Chart handouts

**What will the teacher need to teach and differentiate this lesson?**

Will need to teach and differentiate the difference between solving for a missing side of a right triangle, and solving for the missing hypotenuse of a right triangle.

**Motivation:**

Real World applications for Pythagorean Theorem Video Clip(s)**.**

For use in, Baseball, Height of a building or object, distance, building a ramp, measuring a television.

**DAY ONE**

|  |
| --- |
| ***Lesson Plan Out-Line for Teacher(s)*** |
| **Content Teacher & Special Education Teacher**  Will review schedule with all students. Go over lesson plan and objectives.  **Special Education Teacher** -**Opening**  Will review basic math vocabulary related to the lesson and objectives.  **Content Teacher** -**Opening**  Will review basic math computation skills needed for the lesson. IE. Squaring, Square Roots, Inverse Operations.  **Content Teacher** -**Overview**  Will lead class through a Video presentation on The Pythagorean Theorem  Students will take notes, and work out examples that are contained within the Video.  Content Teach will pause the video and model how to solve each problem working in tandem with the Special Education Teacher.  **Special Education Teacher** -**Overview**  While Content-Teacher leads class through video, the Special Education Teacher will teach the class how to complete a KNSW Chart using the video clips sample Pythagorean Theorem problems.  **Content Teacher** -**Day 1Review**  Review of the basic Pythagorean Theorem equation  **Special Education Teacher**-**Day 1Review**  Review the method for completing a KNSW chart for the Pythagorean Theorem |

**DAY TWO**

**Guided Practice: Lead and Support (30 Minute time limit)**

|  |  |
| --- | --- |
| **Content Teacher** | **Special Education Teacher** |
| Use A+LS Pythagorean Theorem Lesson Practice.  Work out 3-4 Practice Problems with the class    Have students complete the remainder of the practice problems, (one at a time)  Remainder of class solves the problems at their desk, will raise their hand when complete, to be checked by teacher.  Once all students have solved each problems, have volunteer students complete the remaining problems up on the white board. (2-3 students up a white board at a time) Have the students check for correctness and completed steps. ( there are 30 questions in the practice, each student should be able to complete a problem at the whiteboard) | Will work with ESE students in the classroom  Sit in a circle and with a portable white board, work out 5 of A+LS practice problems.  Have ESE student’s complete KNSW and copy teacher’s examples.  Assign each student a practice problem of their own to complete from a list of equations.  Once each student has completed their problem they will model it for the group on the portable whiteboard. |

|  |
| --- |
| ***Lesson Plan Out-Line for Teacher(s)*** |
| **Content Teacher & Special Education Teacher** |
| Content and Special Education Teacher Groups will come together for the last 25 minutes of class.    Co-Teachers will lead students through a Power Point review of the Pythagorean Theorem, as a review of the Day One and Day Two material. (copy of Power Point will be given to ESE students to follow during the presentation) |

**Independent Practice/Cooperative Practice**

|  |  |
| --- | --- |
| **Content Teacher** | **Special Education Teacher** |
| Have students pair up (based on standard class pairs) and solve two sample problems each, two for each member of the pair. (problems will come from FCAT Practice Booklet, each group will be given a sheet with four problems written on it)  As student pairs complete the problems have them raise their hands and have their work checked by the Content or Special Education Teacher. | |

**DAY THREE**

**Assessment**

|  |  |
| --- | --- |
| **Content Teacher** | **Special Education Teacher** |
| General Education and ESE students will take a 10 question, computer based Pythagorean Theorem based assessment. (students will have already practiced solving problems from the computer bases assessment on Day Two) TIME LIMIT 30 MINUTES (ESE students can use their notes and KNSW charts)  Students will Pair-Up with Day Two Partner and create Four (4) Pythagorean Theorem based questions, and turn them in at the end of the class period ( Teachers will need to stipulate that a minimum of two must be word problem based questions, remaining two can be visually based, and or equation based problems)  Student questions will be reviewed by Content and Special Education Teacher. 15 questions over all will be selected and administered to the students on **Day Four** | |

**Day Four**

|  |  |
| --- | --- |
| **Content Teacher** | **Special Education Teacher** |
| Student questions will be reviewed by Content and Special Education Teacher. 15 questions over all will be selected and administered to the students.  Students will have 40 minutes to complete the secondary assessment  Students will then split into two groups and participate in a group review of the lesson material 10 Minutes  Content Teacher will lead the discussion with the general education students  Special Education teacher will lead the discussion with the general education students  The two groups will reunite, and selected students from each group will give verbal testimony to the material learned, the applications of the Theorem, real world examples. 5 minutes | |

**Expectations**

**What are the students expected to DO (active engagement in learning) during this lesson?**

Student will actively complete KNSW Math Charts, and Sample Problems.

**Rationale**

**Why is this lesson taught? How will the teacher engage the students in the learning?**

This lesson is taught for several reasons, one it allows a practical application of square root and squaring mathematics. Secondly, students can use the Pythagorean Theorem to solve for the shortest distance between two points, determine length of a sail, the length needed to through a ball in baseball.

**Guiding Questions**

**What questions will introduce the lesson? Remember to use the various levels of questions.**

Have you ever tried to figure out how far a baseball play must through a ball in the in-field? Does the thrower have enough arm strength? How can find out if your Television will fit inside the entertainment center you are considering purchasing. Is the ladder in your backyard tall enough to allow you to climb to the roof of your house, without having to place it in your mom’s garden and damaging all her plants? How long would a ramp need to be to cover a set number of stairs?

**Extensions:**

Students could use the Pythagorean Theorem on the school baseball field.

Students could use Pythagorean Theorem to construct a ramp for Handicap access to a school building ( to supplement existing ramps in other areas)

**Accommodations/Modifications:**

Small group instruction, Whiteboard notes, KNSW chart, notes on exam, copy of Power Point presentation, Peer-Support via Cooperative Learning exercise

**Access Points:  
Independent:** MA.8.G.2.In.d**:** Locate the right angle and the side opposite the right angle (hypotenuse) in a right triangle .

**Participatory:** MA.8.G.2.Su.d**:** Locate the right angle within a right triangle.

**Supported:** MA.8.G.2.Pa.c**:** Recognize the longest side (hypotenuse) of a right triangle.

**References**

**A+Anywhere Learning System**

[**http://www.amered.com/research\_2.php**](http://www.amered.com/research_2.php)(listed of research studies done on the A+Anywhere Learning System)

**Florida Math Connects Course 2 Text Book**

(Brevard County 2010-2011 Newly adopted Math Curriculum)

**Discovery Education**

Curriculum Content Search Feature, Blackline Masters Lesson Plans and Study Guide, Peer Reviewed and created material, Brevard County Schools approved educational tool.

Graphic Organizers

<http://www.psea.org/uploadedFiles/TeachingandLearning/Special%20Ed%20Graphic%20Organizers.pdf>

<http://www.mentoringminds.com/graphic-organizers.php>